

full egg-cases attached to their abdomens. I put several individuals into different aquaria, and was much annoyed to find that they fell victims to various enemies during the night. A *Dytiscus* beetle, the presence of which had been forgotten, accounted for four, and four more were apparently devoured by insignificant fresh-water snails. Those, however, that were placed in a tank by themselves are alive and well, and feed on the green algæ supplied to them. The males are about $1\frac{1}{2}$ inches long, the females rather smaller.

When the river comes down in flood experience shows that it is time to be on the look-out for zoological curiosities. Perhaps *Apus* itself may reappear once more now that *Cheirocephalus* has shown the way!

Eton, March 5.

M. D. HILL.

The Formation of Large Drops of Liquid.

THE following experiment, based on the temperature-density relations between aniline and water, serves to illustrate to an audience the various shapes through which a drop passes in the course of its formation. A glass beaker, about 9 inches in height and $4\frac{1}{2}$ inches diameter, is filled to about 7 inches with distilled water, and about 80 c.c. of aniline are added. The beaker is then placed on a burner, and the temperature raised until the aniline floats to the surface of the water. On spreading out at the surface the aniline is cooled, thereby becoming denser than the water beneath. A large drop, 1 inch or more in diameter, then detaches itself from the mass at the surface, the formation being so slow that the altering shapes of the drop, the drawing out of the neck of liquid, and the thinning of the neck in two places may easily be observed. The large, detached drop falls to the bottom of the beaker, and is there re-heated, thereby again becoming lighter than the water, and rising to the surface, when a second drop is formed. By maintaining the temperature about 80° the formation of drops continues indefinitely in the manner described. The slightly pink colour assumed by the aniline enables the experiment to be seen clearly from a considerable distance, and the many beautiful shapes assumed by the drops lend an added interest to this simple method of demonstrating their formation. CHAS. R. DARLING.

City and Guilds Technical College, Finsbury.

The Fertilising Influence of Sunlight.

THE letters of Mr. and Mrs. Howard and of Dr. E. J. Russell in recent issues of *NATURE* point to the conclusion that the partial sterilisation of the soil improves its fertility. In connection with this subject, I would like to record that the effect of heating the soil has been observed here for some years. It has been the practice to collect all the refuse of the place that cannot be rotted, such as hedge cuttings, tree prunings, &c. These are placed on a vacant space in the kitchen garden and a fire made of them in winter. The fire is generally a large one, burning fiercely all day, and the larger branches keeping it going all night.

In the following summer the site of the fire is well marked. The rows of vegetables where they pass over it are more than a half stronger than at other parts, though they do not keep that proportion to the end of the season. The increased growth seems to be due to the heating of the soil, and not to the large amount of wood ashes left by the fire, as these are either lifted and used as a top dressing for borders where the spade cannot be used, or are spread over the vegetable ground, the site of the fire being generally left quite bare of ashes.

Ardenlea, Falkirk, March 8.

JOHN AITKEN.

MOLES AND MOLEHILLS.

LIKE that of other common animals, the complete life-story of the mole has yet to be written, exceedingly little being really known. The difficulties of observing the habits of a subterranean dweller of a most retiring disposition are patent but not altogether insuperable, and the wonder is that field naturalists have been content to read and take for granted the information handed down for the last century without any attempt to confirm it.

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During the winter months one cannot help noticing in the open fields here and there a mole-heap conspicuously larger than the rest. This is a male mole's winter habitation, but at present we do not know whether he lives alone or with his wife, or if the female ever constructs these "fortresses," as they are called. Probably he lives alone, and probably females make "fortresses" slightly more simple in construction and smaller in size than those of the males. If we take a spade and carefully slice away the top of a fortress, we shall find several hollow tunnels or runs, which may be opened up and followed to the base of the "fortress," whence they lead away into the field. Slicing further under these into the "fortress," and

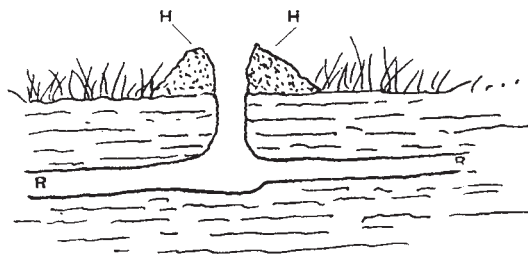


FIG. 1.—First stage of the fortress—sectional view. R R, Mole's run below the surface; H H, heap of ejected earth.

just below the ground-level, we come upon a large circular cavity filled with a bundle of grass or dead leaves; this is the mole's nest in which he sleeps. If he has lately quitted it the interior will be quite warm to the hand; the mole himself, however, will never be caught in the nest. When the nest is removed and the cavity examined, it will be found about a foot in diameter and worn smooth by the mole wriggling about as he wraps his nest round him, for that is his method of arranging himself within it. Two or more tunnels will be found leading away from the nest-cavity into the field. One of these is particularly noteworthy, as it is found in nearly every fortress;

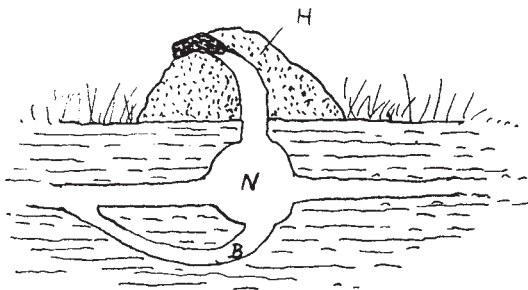


FIG. 2.—Second stage of the fortress—sectional view. N, Nest-cavity; B, bolt-run; H, heap of ejected earth.

this exit leads from the bottom of the nest perpendicularly downward for about a foot, then, turning upwards, it joins another run. Its origin and use are uncertain, but it is usually regarded as a sort of sally port, and is known as the "bolt-run."

It is extremely unlikely that the mole deliberately selects the site of his fortress, as he is practically blind; probably he sets to work whenever the impulse seizes him, and proceeds in the following manner. He commences to enlarge a nest-cavity, ejecting the earth which he has loosened with his powerful claws out of a hole in the roof; this he does with the top of his head in little jerks. The quiet observer may see a sausage-shaped mass of earth issue from below

with four or five sudden jerks, then, after one or two minutes' interval, when the mole is collecting more loose earth, another sausage will appear as before, and so on until the work is complete. After the nest-cavity comes the excavation of the bolt-run, and finally, to make all safe and waterproof, the mole piles up a mass of earth, often amounting to a large barrow-load, by means of tunnels around the base of the existing heap. These tunnels sometimes break into one another and sometimes into the nest-cavity, and so cause a labyrinth which has given rise to much erroneous speculation in the past.

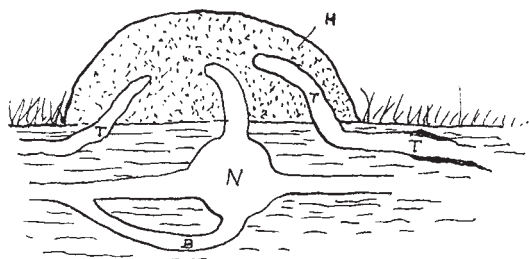


FIG. 3.—Sectional view of the completed fortress. T T, Tunnels formed in piling up earth from outside to make the nest rainproof.

A fortress is often completed in a single night. The young are not born in the winter "fortress," but in a separate habitation made by the female alone. It is built on the same plan as the "fortress," but usually simpler in construction and without the bolt-run. The female produces only one litter a year, and the young, which are born from the end of April to the end of May, vary in number from two to six. Naked, blind, and pink, they turn lead-colour in ten days; after a fortnight a grey velvet pelage is visible, which becomes black at the end of three weeks, when the eyes open. The ears are opened on the seventeenth

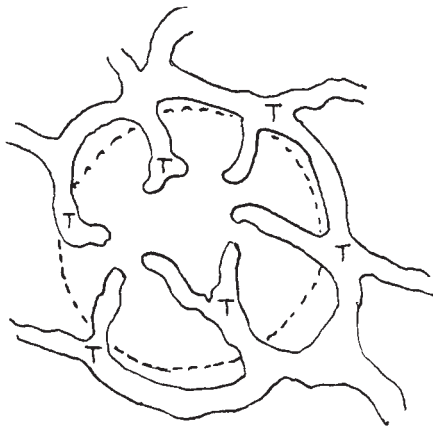


FIG. 4.—The completed fortress viewed from above, with the tunnels T T, &c., laid bare.

day. Attempts to rear the young by hand have hitherto proved futile, for, though they will suck freely from flannel or cotton wool soaked in warm milk, they pine and die on the third or fourth day.

There has always been much discussion as to the mole's power of sight. Dissection has shown that the size of the eye is greater in the embryo than in the adult, indicating that the sight of the race has deteriorated. From numerous experiments the writer is convinced that the adult mole is practically blind. Moles encountered in the day-time have taken no notice of a human being waving a hand close in

front, nor at night do they show signs of consciousness of a light waved before their nose; but, if the slightest sound is made, the greatest excitement is instantly shown. The writer has often thrown down worms before a captive mole to test the sight. At once the mole becomes aware of the worm, but the haphazard way in which he will poke about for it with his snout shows clearly that he is guided by scent, and perhaps by hearing, but not by sight. It is true that at the least excitement the fur will radiate round the minute eye, and it has been suggested that the animal thus clears his eye to see; most probably, however, this mechanical action is retained though no longer of use, since the blind eye cannot benefit thereby. When, after a hurried and blundering search, the worm has been located, the mole holds it down with his fore paws and eats it from end to end with quick, jerky bites. When the animal's immense appetite is at length satisfied and worms are still being supplied, the mole will often give the worm several bites to disable it, and will then cram it into the earth, presumably to bury it for future use—after the manner of the dog with bones and the squirrel with acorns.

The senses of smell and hearing must be very acute to enable the mole to locate a pheasant's or partridge's nest above his run. That this is the case is testified



Photo. by

T. Bellchambers.

FIG. 5.—Young moles ready to leave the nest.

by two gamekeepers in different parts of the country, both of whom state that the nests are often entered from below and the eggs eaten.

It is surprising how soon a captive mole becomes indifferent to being handled. Within half an hour of capture it may be stroked and scratched without causing alarm; the writer has even suspended one by the tail without causing the animal to cease from lapping water. Of course, gentle handling is necessary, and avoidance of any sudden or jerky movement. Another mole soon learnt to come out of his nest and look for worms when the writer scratched the side of the packing-case in which the captive dwelt.

LIONEL E. ADAMS.

THE SOUNDS OF THE HEART.¹

THE sounds of the heart have always occupied the attention of physiologists both as regards their cause and as to their relations in time to other phenomena of the circulation, such as the impulse of the heart on the wall of the chest, and the pulse in arteries and other organs more or less distant from the heart. During the last few years much attention has been paid to these time-relations, and much

¹ Phono-Kardiogramme von Prof. Otto Weiss. (Jena: Gustav Fischer, 1909.) From Prof. E. Gaupp and Prof. W. Nagel's *Sammlung Anatomischer und Physiologischer Vorträge und Aufsätze*. Heft 7. A full bibliography will be found in Prof. Weiss's paper. Pp. 37. Price 1.50 marks.